



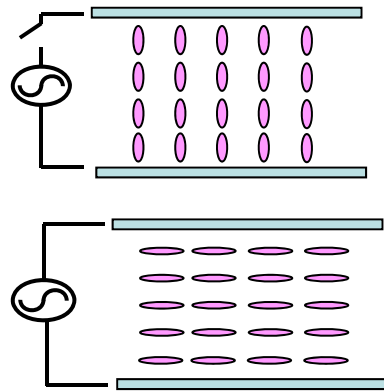
VTN Introduction

VTN Definition

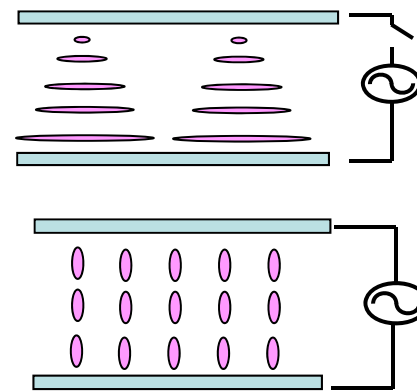


Vertical Alignment

VTN is one of the basic LCD modes. The main difference between VTN and TN/STN is the alignment. For VTN, the LC molecules are aligned perpendicularly to glass substrate.



VTN



TN-LCD

Features of VTN

- True black background
- Ultra high contrast ratio:
duty < 1/8 : 1000:1 or even higher
1/16 ≥ duty ≥ 1/8 : 200:1 or even higher
- Ultra wide viewing cone:
- Temperature independence:
Background color doesn't change at -30 °C ~ 80 °C
- Suitable for all backlight



VTN Versions



1. General Version
2. High Duty Version
3. High Reliability Version
4. Full Viewing Angle Version
5. Field Sequential Color Version

General VTN

- Top: -20 °C~70 °C
- Tst: -30 °C~80 °C
- Contrast Ratio: > 1000:1
- Duty: static ~1/5
- Vop:
 - 1/4duty, 1/3bias: 3.5V~5.0V
(3.0V@ 70 °C Storage)
 - Static : 2.6~4.5V
(2.2V@ 70 °C Storage)
- Viewing cone@CR≥20:1
 - Vertical: +60° , -20 °
 - Horizontal: ± 60°



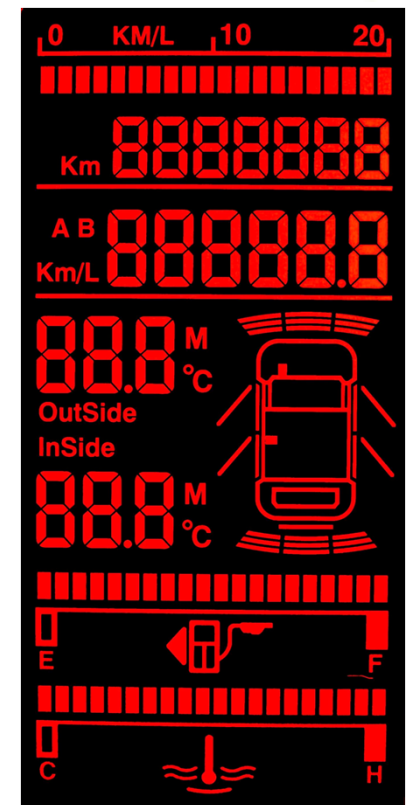
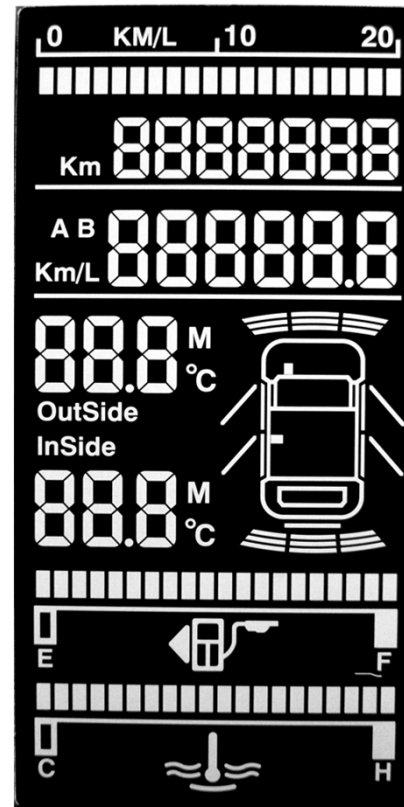
High duty VTN

- Operating temperature: -20 °C~70 °C
- Storage temperature: -30 °C~80 °C
- Contrast Ratio: > 200:1
- Duty: $\leq 1/16$ (~1/64 duty under developing)
- Operating Voltage: 4.5V~8.0V@1/8 duty
5.0V~10.0V@1/16 duty
- Viewing cone: Vertical@CR $\geq 5:1$: +60° , -10° , Horizontal: $\pm 60^\circ$



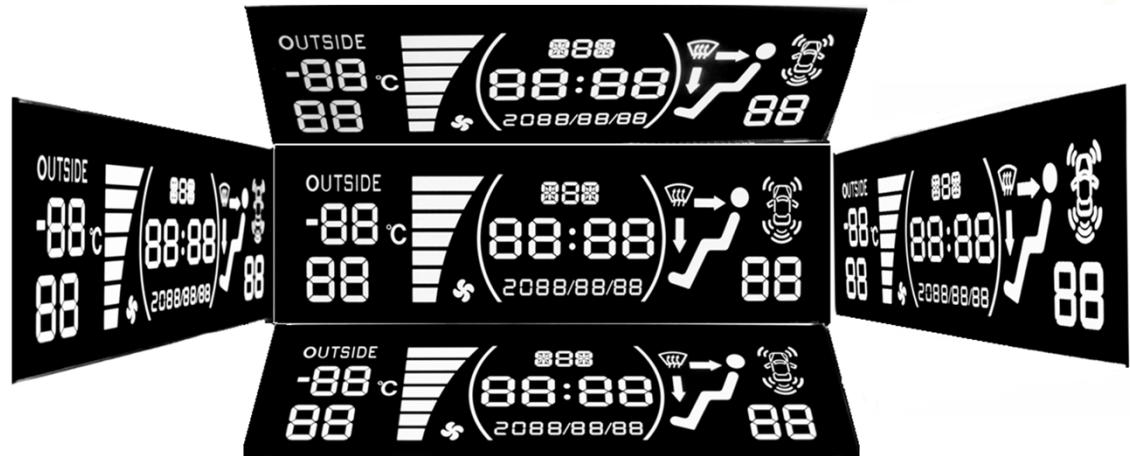
High Reliability VTN

- Top: -30 °C~80 °C,
- Tst: -40 °C~90 °C,
80°C×90%RH×500H
- Contrast Ratio: > 1000:1
- Duty: static, static ~1/4
- Operating Voltage:
4.5V~5.0V @1/4 duty
- Viewing cone@CR≥20:1
Vertical: +60° , -20° ,
Horizontal: ±60°



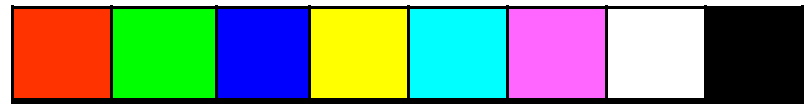
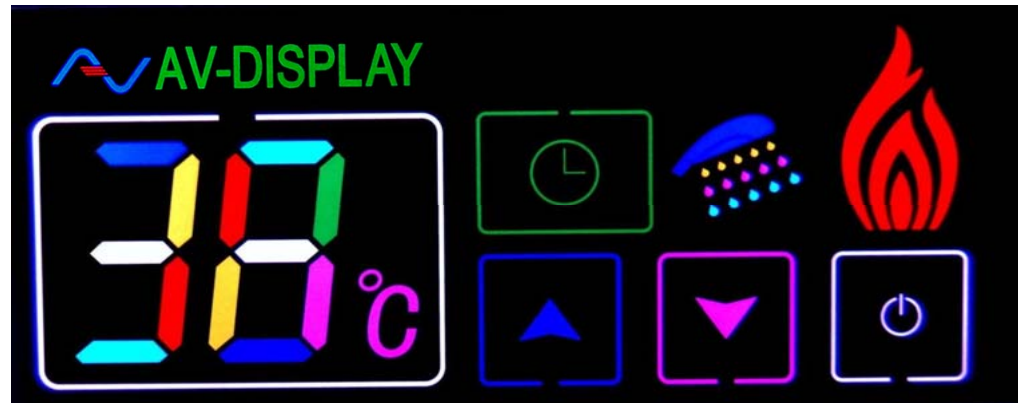
Full viewing angle VTN

- Top: -20 °C~70 °C
- Tst: -30 °C~80 °C
- Contrast Ratio:
> 1000:1
- Duty: static
- Vop:
2.6V~4.5V
- Viewing cone@CR≥20:1
Vertical: $\pm 60^\circ$
Horizontal: $\pm 60^\circ$



Field Sequential Color VTN

- Top: 0 °C~70 °C
- Tst: -30 °C~70 °C
- Duty: Static
- Contrast Ratio:
> 500:1
- Vop:
Vdd 3.0~5.0V
- Viewing cone@CR≥10:1
Vertical: $\pm 60^\circ$, -10°
Horizontal: $\pm 60^\circ$
- Color: 8 colors



Applications with VTN

White Goods

Consumption Electricity Monitor

Automotive



Reference customers with VTN Products



Comparison with different Technologies

LCD Tech	Contrast	Viewing Cone	Respond Time	Background Vs Temp change	Cost
TN Pos	5:1	Normal	Normal	Normal	Low
TN Neg	40:1	Narrow	Normal	Obvious	Low
ETN	50:1	Normal	Low	Normal	Middle
ASTN	60:1	Normal	Normal	No change	High
VTN (Static~1/8duty)	1000:1	Wide	Normal	No change	Middle
VTN (1/16duty)	200:1	Normal	Normal	No change	High